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#### Aeronomy

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J. Geophys. See., Oraco, Paper 101045

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HEASURDERT OF VOLY/METER VERTICAL SLECTELC FISIDS
IN THE MIDDLE ATMOSPHERE
S. C. Maynard (Laboratory for Entraterreserviel Physics, Godderd Space Filght Center, Greenbult, MD 20771), C. L. Croskey, J. D. Mitchell sed L. C. Hale (innesphere Research Laboratory, The Fannsylvacia Stats University, University Fark, PA 16807).

16807). A lest flight far a estime of middle etomophere alectrodyomerics rockets was issuehed Yrom Faileps lained, Virginia, at 7:13 EST no July 31, 1988. The mother-dampture somifyuration contained a three axis symmetric double probe electric lield lestrament and a blunt probe on the dampture payload, and a Gardleo condenser and a single unis (vertfcel) september to double probe electric Finish instrument on the outher payload. The payloads reached so appear at lit ha, and date were guthered from all instruments on the downley. A downless vertical electric lield alth a markets maplitude of about 8 Vm when shearyed to a lever-napilitude of about 8 Vm when shearyed to a levernewhork vertical electric light alth a markers maplitude of about & 1/m was observed to a layer between about 57 and 67 ke. The integrated potential across this layer was approximately 20 ky. Conductivity measurements Andicated that Tras electrons were absent from the region of large sisceric Fields between, the decrease in tonductialty was insefficient to maintain vertical current continuity through the layer. These results setablish the selected of large measupheric electric fields, supporting previous tabulas from single sale measurements.

# **Exploration Geophysics**

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Institutes of Technology, Cambridge, MA 02139) D. 7.
Illis, and J. 8. Webl
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Russell Robinson (Geophysics Division, Dail, Sax
1320, Wallington, New Lealand) H. M. Tyer
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# ISEE 3 in Real Time: An Update

J. A. Joselyn, J. Hirman, and G. R. Heckman

NOAA/Space Environment Laboratory Boulder, Colorado

in the October 9, 1979 Issua of Eos, Taurulani and Bakar [1979] expressed tha tangible banefits of obtaining salected interplanatary data from the ISEE 3 spacecraft in real time. As shown in Figura 1, raproduced from Tsurulani and Bekar, ISEE 3 is positioned between the earth and the sun in a halo orbit shout the sun-Earth libration point. This locaton is well aulted to provide advanced warning of the onsat of geomagnatic disturbances. Although the data were not originally intanded for reat-time use, NOAA and NASA bagan to cooperate early in 1979 to solve the lachnical and dministrative problems requisite to acquiring the raw dela before adting and transmission to the axparimenters. In March 1980 the data straam began arriving at the Space Environment Services Canter (SESC), Boulder, Colorado. Daily data covarage varias but averagaa near 80%. Tha dala ara now baing routinally used to support SESC military and civillan customars and the scientific community at

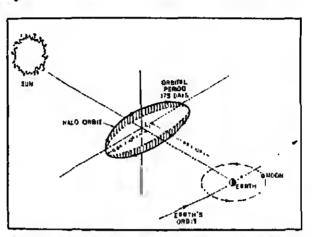


Fig. 1. The infernational Sun Earth Explorer 3 orbit about the

SESC (a joint operation of NOAA and the Air Force Air Westher Servica) is an around-lhs-clock cantar that closaly monitors solar and geophysical conditions, issues warnings and alerts of special events, and writes twice-daily summaries and forecasis of the overall laval of activity. Realims and near-real-lima data are roulinely obtained from a thein of cooperating solar optical and radio observatorias, including the remaining atations of the international Magnasopheric Study Program. Although interplanatary data have been provided in the past by Plonears 6-9 and Vala spacecraft, and are now available by raquesi from the prinopai investigators of Pioneers B-9 and the Pioneer Vanus Orbitar (dapending upon a favorable location of Venus), ISEE 3 provides a vital platform for measuring ambient conditions in the solar wind some lens of minutes before Earth is impacted. In the past faw months, this capability was aspacially halpful in providing aupport to NASA for the first flight of the shuttle Columbia and to the international European Energy Budgel Campaign organized by D. Offar-

Table 1 lists the expariments and the principal investigators who have released their data to NOAA specifically for teal-time use. Additional details about the experiments are contained in a spacial leave of the IEEE Transactions on Geoscience Electronics [IEEE, 1978]. The raw data anter he SESC data basa, SELDADS (Spaca Environmani Laboslory Data Acquisition and Diaplay Systam), via relay MON NASA's Goddard Spaca Flight Centar through NOAA's National Environmental Satellita Canter. At SESC the data are processed, atorad, and displayed in savaral mais. Beaids appearing on continuous paper strip tharts, the digital data are flashed on a monitoring screen hal is updated to ourrent values avery 6 s. As the data are vad and displayed, aimpla analysia is done to show the last clock time at which the interplanalary field turned Southward plus a rough intagration (gamma minutas) to help the forecaster evaluate how strong and persistent any buthward field has been. The calculated valocity of the soar wind is used to show an aslimated hallolongitude of the burce of the solar wind, and there is an automatic shock delection massaga based on naar-atmultaneous increases of more than 50% in total magnetic field intensity and adar and density and at least 60 km/a in valocity. The data resking in the SESC/SELDADS are available for printout and Pols on variable time acaias, in particular, the southward component of the interplanatary field can be displayed in Wo coordinate systems; solar ecliptic coordinates and solar magnetospheric coordinates. The algorithms for the latter ransformation were provided by Roy Okida and Bruca Isuniant of the Jet Propulsion Laboratory, California institule of Tachnology.

Al present the data are being used at three operational levels. On a routine level the ISEE 3 X ray delectors provide a training level the ISEE 3 X ray delectors provide a training level the ISEE 3 X ray delectors provide a training level the ISEE 3 X ray delectors provide a training level that I Mos a valuable backup and extension of data recalved from MOAA/GOES satellites. Table 2 liets the anergy ranges of the satellites. the real time (SEE 3 X ray channels and the NOAA/GOES) thannels. The intensity of the X ray flux at energies greater than 20 keV has bean abown to be an indicator of the production of solar protons (Lin and Hudson, 1978). The Injury planetary plasma and magnetic field data provide valuable

TABLE 4 JOSE A Data Assurant to Const. The

TABLE 1. ISEE 3 Dete Acquired in Real Time							
Experiment	Principal Investigator	Approximate Sampling Rate	1-min Dete Bese Veluee	Acquisition Date			
Solar X reys nterplaneisry Magnetic Fields	K. A. Anderson, Univ. of Calif. E. J. Smith, JPL	120/mln 360/min	Peek; averege medlen Avarage medlen	Merch 21, 1980 Merch 21, 1980			
Solar Wind Density, Velocity	S. J. Beme, Los Alemoa Scientitic Lab	1/1.5 mln	Sampled vetue	Merch 15, 1981			
lasma Weve (3 kHz) Electric Fields	F. L. Scarf, TRW	120/min	Peek; everego medlen	March 21, 1980			

synoptic information. The general eximuthal direction of the magnatic field (s.g., toward or away from the aun) and the valocity are used in comparison with solar disc magnetograms from the Kiti Psak National Observatory to delermina tha large-acaia source of tha solar wind. Sacior boundaries and other discontinuities in the direction of the solar wind are espacially obvious. High-spaad, low-dansity solar wind streams can be Identified with specific coronal holss obsarved in hallum 10B30-A spactrohallograms Iransmitted daily from Kitt Paak.

At an avant-moda leval, the ISEE 3 solar wind data can identify abrupt interfaces and shock waves in the solar wind. Whan Ihasa shocks impact tha magnatosphara, thay are seen al geosynchronous satallite and low-lalituda ground-based gaomagnalic obsarvatorias as suddan impulsas in the horizontal component, which may be storm suddan commancemanta. Figura 2 illustratas a saquanca of observations on July 17, 1980. The discontinuity in the total interplanatary magnatic field at ISEE 3 occurred at 1840 UT (solar wind dansity and valocity data wara not available). Previous to the detection of this shock, we had noted anhanced notes in the 3-kHz pleamo wave experimant. Those smissions ere due to instabilities driven by enargatic prolons flowing upstraam of the ahock and are often saan to preceda intarvals of shocked or highly disturbed conditions in the solar wind [Scarf, 1977; Kannel at at., 1981]. Fifty minufas latar, at 1930 UT, the impulse was rag-Istarad at the low-latitude IMS stations. The delay time for the distance from ISEE to Earth of 1.5 × 106 km implied an assumed constant shock valocity of 500 km/s and an axtrapplated dalay from the sun to Eerth of 3.5 days, This travel Ilma corrasponds with the occurrence of an X1/1 bright flara on the sun on July 14 at 0830 UT. From March 21, 1980, Ihrough April 30, 1981, 30 apparant shocks at ISEE 3 have been identified with sudden impulses on the ground. Twanty-threa impulses in the geomegnatic field occurred at Ilmas when ISEE 3 data wars not available. Howevar, not all shock signatures sasn at ISEE 3 can ba identifled with magnetic impulses at Earth, and not all suddan impulsas on the ground can be identified in ISEE 3 date. Many shocks cannol be readly associated with a spacific flare or other solar evant, such as a fitament diseppearance. Further, the details of the shock at ISEE 3 do not seem to correspond with the datatis of the impulse et the ground. This variety in the event deta exemplifies the complexity of the solar wind and the interaction between the solar wind and the magnatosphare.

Finally, the ISEE 3 solar wind data are a potentially quentitativa predictor of geomagnetic storms and subslorms. The key to quantitative prediction is an understanding of the mechanism of anargy coupling between the solar wind and the magnatosphara. Numerous algorithms ratel-Ing solar wind paramatars to gaomagnetic indexas hava baan proposed. (For discussions, saa Crooker [1975]; Russell [1980]; and Donnally [1979].) We have presently implemanied only two of these predictors. The first algorithm is Amoldy's [1971] Intagration of the southward component of the interplanatary stald. As axplained abova, this value is

TABLE 2. ISEE 3 and NOAA/GOES X ray Date

Date Chennel		Energy Plange
	ISEE-3	
SC 1		12-20 keV
SC 2		20-36 keV
SC 3-4		36-52 keV
	NOAA GOES	00 22
'long'	7107110020	1.5~12 keV
'short'		3-24 keV

celculated as a simple summation of the magnitude of the southward field and is displayed in units of gamma minutes in razi time. The integration is terminated during those times whan ISEE data are not racelvad or whan B, turns northward, restarting whan the data roaume. Although no permanant rocord of this paramatar has been kept, it has provad to be of value as an indicator of the intensity of geomagnatic activity. Our expartence is in accordance with the wall-known result that pradominately northword fields are associated with vary little geomegnatic octivity; fluctuoting flaids are associated with minor disturbances; consistently southward fields are associeted with activa conditions (K values at Bouldar of 3, 4, and occasionally 5); and strong southward fields ( $B_s > -10 \text{ y}$  and  $\Sigma B_s t > 1000 \text{ y}$  min) ere associated with storm lavels. After a disturbed period, if the flaid turns and stays northward, magnatic activity diminish-

A sacond porameter prasantly calculated and displayed is 'apsilon,' a function first suggasted by Parreault and Akasolu [197B] that is proportional to solar wind valocity and the square of the total interplanetery field end is strongly weighted lowerd southward fields. Detailed studies of this phramater relote it to AE, which is a global massura of geomagnetic activity substorms in the northern auroral zona AF is not available in real time, aven as an estimate sinca SESC auroral zone observatorias are concentralisd in Alaska, with our aastarnmost data arriving as a summary rsport evary 90 min from Uppar Heyford, England, Navertheless, apsilon parforms as a raasonable estimator of geomegnetic activity in that values greater than the thrashold of 1018 arg/s ara associated with significant geomagnetic activity [Akasofu, 1980]. There are other functions of interplanelary parametere that have been suggested as pradicfor algorithms. Although most are Intended to provide warnings on the ordar of tens of minutes (i.e., the traval time from ISEE 3 to Earth plus some additional lag fima for substorms), some can offer predictions of up to hours. These Includa tha 3-kHz plasma wave noise observations mentionad above and subile density and valocity variations that may signal the approach of a stream interface region in tha solar wind (Gosling at al. [1978]; R. L. Rosanbarg, privata communication, 1980).

In summary, SESC greatly appractate the spirit of axploration and cooparetion that tad to the acquisition of the raal-tima Interplanatary date from ISEE 3. Wa are using



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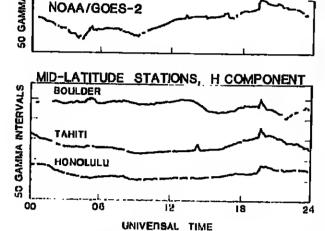


Fig. 2. A sequence of observotions showing evidence of an Interplanalary shock of ISEE 3 and then at Earth.

JULY 17, 1080

those data to support scientific research end provide wernings to commercial and mittery customers. The potentief contained in the data is not yet tuty realized, but we ere Implementing suggestions and algorithms to the best of our ebility. For edditional information about real-time date services, pleese contact the authors at the address given



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Cover. in the now AGU publication, Earthquake Prediction—An International Review," K. Mogi describes the progress of the extensive Jepanesa program in earthquake prediction which began in 1965. As part of this program, observations of various geodetic, geophysical, and geochemical paramaters are being made throughout Japan in order to monitor pramonitory effects of earthquakes, including crustal deformation (a-strain and till meters, b—Iriangulation, o—leveling, e—tide gages) and selemicity (d—selemic elations of the Japan Meteorological Agency, f—mi croearthquake networks). See page 619 for details.

#### Acknowledgments

The ISEE 3 deta elream and present atele of enelyste could not have been possible without the personal attention of the following individuals. Their essistance is gratefully ecknowledged: C. E. Hornbeck end the entire steff of the NOAA/SEL Real Tims Date Services, especially including R. Hinee; J. D. Schiceder, III; L. Thomas; J. Abeyte; D. Wasmundt; and A. Gray; R. Walea and J. Spohr of NASA/GSFC Salelite Operationa; B. Teuruleni, J. Wolt, and A. Frandaen of JPL; W. C. Feldman, R. Anderson, and E. Tech of LASL; P. Harvey, H. Primbsch, end S. Kane of the Universily of California; F. L. Scarl and W. Taylor of TRW; S.-I. Akesolu of the University of Alaske; and R. Donnelly of the NOAA/Space Environment Leboratory.

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# News

#### Magnetic Monopole

The magnetic monopole, or magnetic point source (as opposed to the conventional concept of a north-south megnetic dipole), is egsin in the news, es it has been off end on for the past 50 years. Perhaps it is more precise to sey that another episode in the continuing eearch for the elusive monopole is underwey.

In a recent report by the National Science Foundation (Mosaic, 12, 1981, p. 19) It was steted of the monopole, 'If lhere is a dogme in modern physics, it might be that in nature anything not expressly forbidden to exlet by a specific lew must be presumed to exist. . . . Physicists ere just going to have to get clever enough to find them.' In the eyee of the numerous investigatore who have seerched, monopoles are not just objects that exist by theoretical defeult, they are ercane, perhape, but real.

in the lors of eclence fantesy, monopoles are like sntigrevilation machines in magnetic fields. The theory is that e monopole draws energy from and destroys megnetic fields. in e prees interview held in Houston et a luner science conlerence e few yeere ego, geophysicisi Buford Price of the University of Celifornis (Berkeley), who was then end is now involved in the search for the monopole, made the elarming statement that a controlled monopole might meke e good 'rey gun' lor epacemen. The hard fects are thet through the yeers Price and others have eeerched for the monopole as the 'missing link' in electrodynemic lineory. Its existence would provide the essentiel belance needed for Maxwell's equellon.

In 1931, Paul Dirsc wrote a prediction theory for the magnetic quantum, the monopole. The theory was logical, but the monopole was eluelye as it turned out. Investigatore hed no luck in their search for the monopole; il was to be 30 yeers before a significent effort was made. In the early 1960's, field men doing geology end geophysics research in the Adirondaks led e teem of investigators through iron deposits es part of a new eeerch of Iron-bearing natural metertels (minerels, rocks, meteorites). The idea was to ettraci any monopoles into e porteble electromagnetic field and onto en emulsion detector. The monopoles, it was thought, would have lodged in the weak fields of en Ironrich meterial, after heving been created in the upper etmosphere by colleione of atmospheric molecules with high-snergy cosmic rays. The results were negetive. With similarly negetive results, millions of cubic centimeters of ocean weter were tested et the Fermi Leboratory in Batavie, Illinois,

and teete were conducted in the etmosphere with belloons. Now the seerch has seperated into two lines of pureuit: creeling e monopole in the laboretory and seerching in spece. Bulord Price end his coworkere are using the particie-irack techniques, ol which he was a coinventor, to detect monopoles that mey have been created during particle ennihilellon experiments at SLAC (Stanford Lineer Accelerelor Center). The detectors are set up along the poeltronelectron ring at SLAC to meke observations during particle collisions of eeverel tans of billions of electron volls. The hope le that monopoles can be created in this energy

The seerch in space includes en exemination of pulsare, and the effects that could have been caused by monopoles produced by high-energy collisions at a pulsar's surface. The appropriate polarity of monopole would drive into the parent pulsar, and being of euflicient number, would slow down the pulear's rotation. The opposite polarity monopole would drive into epace, and according to the processes, both north and south polarizations could accelerate into the

coras of pisnets (once they mada it into the gelaxies). According to theory, monopolee can be large, even immense. The mess equivalent per particle of the large onee could be on the order of 1022 eV. If entrapped in a planet'e cora, immenae monopolee could effect the release of an appreciable amount of heat. What else they could do is in the realm of speculation.

The existence of the monopole is not required to explain magnetic or electromagnetic processes per se; they are necessary only to complete the symmetry of Maxwell's theory. There may be a range of sizes of the monopole, from the orderly size of 1 or 2 fene of electron volfs to the gigantio They may be hard to detect because conventional the ory le inadequate fo describe their properties. The search continues, nonetheless, and Price and others associated with the current experiments remain epitimistic PMB 88 

#### Peru Earthquake Prediction Updets

Brien Brady of the U.S. Bureau of Mines has sitered his prediction that three mejor earthquekee will rock Lima, Peru, thie summer (Eos. March 31). He had predicted that e magnitude 7.5-8.0 event would occur on or ebout June 28, followed by a megnituda 9.2 event (Ksnamort scale) on or about August 10, and a megnifuda 9.9 event on or about September 16. No such eerthqueke occurred in June.

Without the occurrence of the tirst queke, the other two 'ere very improbable,' Brady told Eos. He communicated the updete in a personal letter to Alberto Giesecke, the retired heed of the Peruvien Geophysical Institute. Bredy said he has not mede a substitute specific prediction. In Jenuery, the Netlonel Eerthquake Prediction Evaluation Council rejected Bredy's prediction, seying they were unconvinced of the scientific velidity of the forecast.—BTR S

#### Senate Confirme Keyworth

The Senete confirmed George Keyworth on July 24 as the director of the Office of Science and Technology Policy. Keyworth, former leeder of the physice division of the Los Alemoe Scientific Laboratory, was recommended to the Senete following a hearing with the Commerce, Science. end Transportetion Committee on July 20. The hesting was organized by the Subcommittee on Science, Technology, end Space, chaired by Senator Harrteon (Jack) Schmill (R

The confirmation tollows by 2 months President Reagan's announcement of his intention to nominate Keyworth-BTR

### **Gold Assures Methane**

There is enough unsepped hydrocarbon fuel to last Earth thousends of years says quaser estronomer Thomas Gold of Cornell University. He theorizes that these deposite of ablogenic methane ere the resulte of the braskdown of hydrocerbons (trapped in the earth as it formed from solar nebula) under the high temperature end pressure that exists in the eerth'e interior. The carbon is thereby released the form of methene gas (CH4), which leaks to the surface continuously, through cracks and tiesuree in the crust. Gold's methane le not to be confused with the biogenic vanety that hae been discovered eo ter (i.e., 'netural ges')

The erguments for the hydrocarbons being in the earth crust are based, in part, on the ebundence of carbon by drogen compounds in epace. Gold and his associets J. Soter, also of Comell, have expleined on numerous occasions how the hydrocarbon molecules associate in melecites end, by analogy, in the earth. What has not been explained so tar, is where these vest gae deposits ere. Gold is erguing that they should be looked tor et natural fault and joint systems. He teels that once proven, the deposits can be tapped and used as an energy source of almost in definite proportione.

Recent reporte (Chemical & Engineering News, July 14 1981, p. 17ff.) of a etudy being done jointly by the Callot nia institute of Technology and the Guit Research end velopment Co. on monitoring gee emissions along the set Andrees rift zone suggest that Gold'a hypothesis mey. tested. Not much funding for the project has been but the study should supply useful data. So far no makes been recorded along the rift (Gold seys the San dreas tault zone le 'too active,' l.e., that methane do accumulate along it, but rather, escapee continuous levele that may be defectable but probably ere not clally viable) but the project is only the beginning of broader effort. Monitoring systems are in the daysoft stage, and given time, it may be possible to feel the stage, and given time; it may be possible to feel the stage, and given time; it may be possible to feel the stage, and given time; it may be possible to feel the stage, and given time; it may be possible to feel the stage, and given time; it may be possible to feel the stage where blogenior methans could not occur.

euch area suggested is the Canadien shield, which sedimentary gas and petroleum deposits.

Many gas emission studies done in other areas the ported, on occasion, defecting methane. Geochemis mon Craig from the Scripos institution of Cosacognilla has detected methane along the East Pacific Files locations include a site in Tibet where methane secure regularly, Yellowstone National Park, and Lake Kivu Tibe occurrence of methane and other gases slong to methane

methane formed, however, and in no inetence, so tar, can it he demonstreted that the methene emissions are related to the manile.

Methene can form easily by cerbon-hydrogen resctions that are other then biogenic. To Gold, however, the idese are etili pratty much unteeted. He suggests isolope associallons with other gases and geographic petterns that can be used to demonstrate a common manile source for the methene. The study of ges emissions from feuit zones is progressing besed mostly on interest in the amount of <sup>3</sup>He that is released from the mantle. Gold's enthusiasm has led to the enelysis of methene during the other studies. The results may support Gold'e ideas, but the fear is that they may not be extensive enough. Some positive results from monlioring over the next year could provide Gold with the basis for obtaining more support.

Gold essures those who question his theory that the gas has to have formed, end he finalsis that the gas is trapped. Gold maintains these convictions emidet a growing consensus of controversy end doubt by many scientists and petrojeum experts. Arguments have been voiced during inquiries by the Department of Energy and by the National Acedemy of Sciences. No one will sey Gold is entirely wrong. Howev er, few believe conditions in the mantle are favorable to trap vast quantitiee of methane, even given the satronomic theory. Oil compenies have found no evidence, even in the deepest wells, but Gold's associate, Soter, says. ...f... think we need to take this hypothesis seriously

because it could be so important if it is correct. 'S

#### Gaophysicists

Donsid L. Turcotte wae appointed chairmen of the Deparlment of Geological Sciences et Cornell University. A member of the Cornell taculty elnce 1959, Turcolle moved from the mechanical and aerospece engineering department to geologicef sciencee in 1973. He succeede Jack E. Oliver, Irving Porter Church Professor of Engineering. Oilver is returning to teeching and research after serving as chairmen for 10 years. Turcotte is president-elect of AGU's Tectonophysics Section and a member of AGU's Publica-

Gereld J. Wasserburg wae ewerded the Arthur L. Day Prize by the National Acedemy of Sciences for hie contributions to the phyeics of the earth. The \$10,000 prize end eclureship is awarded approximelely every 3 years. Wasserburg was honored at NAS' 116th annual meeting.

Laurei L. Wilkening, associate proteesor of plenetery eciencee at the University of Arizona at Tucson, has been appointed head of the department of plenetary sciences and director of the University's Luner end Pisnelsry Laborstory. She succeede Williem B. Hubbard who rejumed to teeching and research on plenetary interiors.

# **New Publications**

A Concise World Atlas of Geology and Mineral Deposits D. R. Derry, John Wiley, New York, 110 pp., 1960, \$61.95.

Reviewed by F. J. Sawkins

This atlas represents an overview of world geology and minarsi deposits that cen, as the author states, be 'understood by the Isyman and yet be useful to professional earth scientists.' Derry has produced en informetive end well-writlen volume that essentially eucceede in thet goel. It consisis of en introductory orientation, an alias with explenaMeurice Ewing Sariea: Volume 4

## **Earthquake Prediction An International Review**

David W. Simpson and Paul G. Richards, editors

The acope of the earthquake observation network has repidly increased. Presented here is research from acientiets worldwide exploring geodetic, aeismic, geomagnetic, geoelectric and geochemical observations with particular attention to crusfal deformation.

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#### Other Titles

Deep Orilling Results in the Atlantic Ocean: Continental Margins and Psiecenvironment (1979), adited by M. Talwant, W. Hay, and W.B. Ryan, 439 pp., \$18.00 (MEO300).

Deep Drilling Results in the Atlantic Ocean: Ocean Crust (1979), edited by M. Talwani, C.G. Harrison, and D.E. Hayes, 446 pp., \$18.00 (MEO200)

teland Arcs, Deep Saa Trenches, and Back-Arc Basins (1979), edited by M. Talwani and W.C. Pliman, 480 pp., \$18.00 (MEO 100).

tory texts, and finelly statistical date on national production end resources of the most important mineral and mineral fuel commodities

The Introductory section, which represents a brief review of physical geology, will mainly be of interest to those without eny earth science background. Il Includes sections on landscape and geology, structure end history of the earth. distribution of eerthquekes end volcenoes, life, and distribution of mineral resources. It is clearly intended to aid the nonprofessional to comprehend better the explanstory matarial that follows in the atles. The finel eection on distribution of mineral resources would, I feel, have been considersbly strengthened by the inclusion of sketches to illustrate the mein types of metal deposits and the manner in which these and minerel fuel deposits ere created. Such maleriel would heve aided all resders unlemliler with economic ge-

The second section contains the real substance of the volume and consiste of nine map sheeta plus extensive expisnatory isxi meterial. The meps, which cover all the lend sreas of the earth, are attractively colored and wilhout undue complexity manage to convey a greet deal of informalion on geology end resource distribution. The choice of ecales end projectione, sithough not uniform, is intelligent. The distribution of metel deposits is indicated by chemical symbols, but care is required here if the resder is not to asin a distorted impression of the relative importance of dilferent eress in terms of their metal production. However, it the maps ere used in close correlation with the text and nationel production and resource statletics in part three, this

problem cen be largety avoided. The most obvious example is the Antarctica map sheet thet contains many symbols Indicative of metal deposits that are at best no more than

The text that eccompenies each map sheel traces the geological development of each (map) area from earliest limes to the present. Most major deposits are mentioned. but, here again some unevenness of emphasis creeps in. For example, no mention is made of the important base metal deposits of New Brunswick and Newfoundland. Despite this, and one or two errors in age designations of important deposits, a great deat of eccurate and useful intormation is presented. Unfortunately, no attempt is made to differentiete the mineral deposits by type.

The world mineral production and reserve data conlained in the third part of the volume are important. They serve to emphaelze the highly uneven distribution of mineral end mineral tuel wealth amongst the verious nations, and, as mentioned earlier, should be used closely with the maps. The linal sections llat eources of turther informalion, both suggested reedings end the addresses of nationsi surveys around the world. A short glossery concludes the volume.

In conclusion, Derry has produced a valueble synthesis on the geology and minerel resources of the continents. Thie volume ahould be of perticular use to geophysicists concerned about the resources of our planet.

F. J. Sewkins is with the Department of Geology end Geophysics, University of Minnesote.

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Pecilion in Reflection Sciemology/Rice University, Noueton, Texes, The Departmant of Geology plane to expand its geophysical program. Emphasis will be on reflection seismology. At this time applications are for the first of two open laculty positions. The succeeduri epplicani will be feel be the search of the search plane. help in the search for and selection of the second

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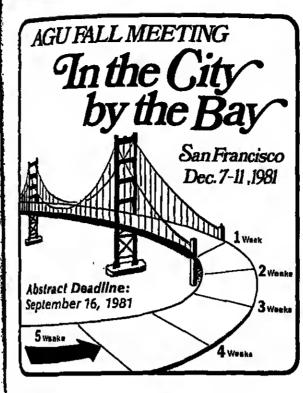
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# Meetings



#### New Listings

The complete Geophysical Year tast appeared in the July 21 Soldiace type indicates meetings eponeored or cosponeored by

0d. 28-30 28th Annual Midwagt Groundwatar Confarence, Blamarck, N. Dak. Sponsors, North Dakota Stata

Jan 24-29 Conference on Origins of Pleames and Electric Fields in the Magnatosphare, Yosemile Netional Park, Calif. Sponsors, NASA, AGU. F.T. Berkey, Center for Atmospheric and Space Sciences, Utah Stete University, UMC 34, Logen, UT 84322.)

Feb. 25-28 13th Annuel Meeting of the Internetional Eroalon Control Association, Salt Lake City, Ulah. (M. McMilten, Erosion Control Consultents, P.O. Box 195, Pinole, CA 94564.)

Mey 3-8 Chepmen Conference on the Discontinuitles in Rock: Their Role end Significence in Geologic Processes, Senie Fe, N. Mex. (Meetinge, AGU, 2000 Floride Avenue, N.W., Washington, DC

May 23-27 Second International Conference on Geological informetion, Golden, Colo. Sponsore, Geoscience Information Society, Geological Information Group of tha Geological Society of London, International Union of Geological Sciences, Association of Chial Libreriene of Netional Geological Surveys, Association of Geoscientists for international Development. (D.C. Ward, International Conference on Geological Information, 223 Natural History Building, 1301 West Green Street, Urbene, IL

Mey 24-28 Joint Internellonal IEEE/APS Symposium, National Radio Science Meeting, and Nuclear Electromagnetic Pulee Meeting, Albuquerque, N. Mex. Sponsors, IEEE Antannee end Propagation Society, USNO URSI Commissione, Permanent NEM Committea. (K. F. Casey, The Dikewood Corp., 1813 University Soulevard, N.E., Albuquarque, NM 87102)

June 21-25 11th Inlamational Lager Radar Conference, Madeon, Wla. Sponaor, Spaca Science and Engineering Center of the University of Wiaconsin. (J. Edwerde, Conference Coordinator, 11th Inlamational Lagar Redar Conlerenca, Space Sciance and Engineering Ceniar, 1225 Weat Dayton Streat, Mediaon, WI 53708.)

Aug. 16-18 International Contarence on Coel-Fired Power Plents and the Aquatic Environment, Copanhegan, Denmark. Sponsore, Internetional Association on Water Pollution Research, the International Union of Pure and Applied Chemistry, Nordic Cooparative Organization for Appliad Research. (Dia Congrese Service, Linda Alie 48, DK-2720 Copenhagan, Danmark.)

Aug. 25-27 23rd U.S. Symposium on Rock Mechanics Berkslay, Cellf, Sponsors, U.S. National Committee for Rock Machanics, Internetional Society for Rock Mechanics, University of California, (Organizing Committee, 23rd Rock Mechanica Sympoeium, c/o Richard E. Goodman, Department of Civil Engineering, 440 Davis Hell, University of Californie, Barkaley, CA 84720.)

Oci. 4-9 Intamational Symposium on Polders of the World, Agora, Leiyatad, The Netherlands. Sponsors, Deperimani of Civil Engineering of the Delft University of Technology, Commission on Hydrological Research of the Netherlande Organization of Applied Sciantific Re-

search, the Ussalmaarpolders Devalopment Authority. Society for Welerworks and Lend Use Plenning. (J. H. Wijkel, Informelion Centra 'Naw Land,' Oostveerdersdijk 01-13, 8242 PA Lelysted, the Natherlands.)

Oci. 18-21 GSA Annuel Meeling, New Orlaena, La. (J. M. Latulippa, Meetings Dapartmant, GSA, P.O. Box 9140, 8ouldar, CO 80301.)

#### 1983

Juna 13-15 International Symposium on Gas Trensfer at Water Surfeces, Ilhaca, N.Y. Sponaors, Comall University, AGU. (W. H. Brutesert, School of Civil and Environmental Enginearing, Cornell University, Holllater Hell, lihaca, NY 14853.)

Oct 31-Nov. 3 GSA Annual Maaling, Indienepolis, Ind. (J. M. Lalulippe, Mealinga Depertment, GSA, P.O. Box 9140, Boulder, CO 80301.)

July 21-28 Eighih World Conference on Eerthquake Engineering. San Francisco, Calif. Sponaor, Eerthquake Englnaering Raseerch Institula. (R. B. Matthiasen, Chair-8WCEE, EERI, 2620 Talegreph Avenua, Barkaley, CA 84704.)

#### 1981 Midwest Meeting Plan to Atlend

#### September 17–18 Minneapolis, Minnesota

Radisson Hotel (Rates: Single \$34, Double \$4D, Triple \$12.5D per person)

#### Spacial Sassions:

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### **Exploration Geophysics**

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#### Geomagnetism and Paieomagnetism

A SIMPLE PHYSICAL MODEL FOR THE TERRESTRIAL

A SIMIL PRISTLA MODEL FOR THE TERRESTRIAL DYNAMO POLAT OF GAS INDEXES A Planetary Sciences Dept. The Johns Hopkins Univ., Beltimore, MD 27218

The hieropth of the earth's magnetic field results from an equilibration bybeen mates of buoyast emergy production and Graic dissipation. Changes in magnetic field, in particular the long term changes is dipole moment, provide as indication of Changes in care energy toorcom, and so become critical data for usders tability the evitual has both the core and deep sentle. A simple physical model is propose to establish a connection between dipole moment behavior and production of buoyasts, and the baselor and production of buoyasts, and thin the core. The model mets on two hypotheres: (1) magnetium is generated by smell scale, retained cominated turbulanch consisting of a field of propagating legicial waves and (2) the turbulence is supposted by a flux of buoyasty, thermal as congostional, originaling either at the core-manile or labes core boundary. The efficiency with which wave kinetic energy is converted to magnetic energy in delar-alined by the near wave hell-

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#### Meteorology

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1720 Climatology HUMERICAL SIMULATION OF THE ANNUAL CYCLE OF CLIMATE MURING THE ICE AGES J. Aden ICentro de Clanciae de la Atrós-Tara, Universidad Nacional Autónoma de Mésico, Mésico 70, d.P.) Mesico, Mesico 70, 4,9,)

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shown that the dilference between the shown that the dilference beyong the positron of the snow-its boundary of 18,000 years ago and the one of today wad much larger in Summet then in Winter and fhat the annual cycle of the snow-ice boundary for today has fore variability then that for f8,000 years ago. Due to the yemporature annualize feadback, the sonally avaraged surface and mean at respect to today's normals are negative and their absolute vafue is nuch larger in Summer then for the other assessme of the year, and increase from lower to the year, and incresse from lower to higher fetitudes. Comperison of the con puted surface temperature values with the values setimated by CLIMAP shows gen the values setimated by CLIMAP shows general good execusit. The computed average surface temperature anomaly for the Northern Hamisphers for July is equal to -4.7°C, in good agreement with the value -4.9°C obtained by CLIMAP. [Annual cycle,

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Considerations are greated which slow for a more quantitative systems to the problem of long-range yealization. It is tupposed that the interacoust westerned of Size-zeering atmosroical interacoust westerned of Size-zeering atmosroical components. One component of size-zeering atmosroical respective components. One component selled "clisate noise" reflect ampling warlability of finite time. components. One emponent solical "climate noise" reflects ampling wether little ("labet leaster reflect ampling wether fluctuations and it it umpredictable at long lead thuse. The remedial wering is around so he potentially reddicable. Glimats solve and potential predictable ("labet with the remedial separations are assisted for Units States etailings. It is farther supported that the potential states are those. It is farther supported that the potential states are those we assess the second of a nongeness that we can. A start is squamed so be in head through its second and states are the second that the southers Osmillacion. The lapons of the social unpredictable pert of the variance, ar "effective relate." The Isab of improving the value of longuages formeste to Searched at one of irrentering some and mars at the potential bis alered in referentering some and mars at the potential this alered in cased. The Isab of improving the value of longuages formeste to Searched at one of irrentering some and mars at the potential bis alered transfer-ring some and mars at the potential bis alered.

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D.E. Proctor [Ambieral Indiffact for Telecomment
cellent Systemch. F.G. Lis 3/10, Jehrhomburg.
Experim of S.H. Africa]
Satic active Error lightoing were abserved at
mendingth of 5.5 in. 59 cm and til co but no
exhous : detected by the 3 cm radar spil
praturally betave its pulsa repetition rate was
too fon. A very small manner of Fishes produced
detectable schaes at 5.5 cm slibnush may Fleshet
were seen passing abroom the back of the radar.
These orders behaved in militer of the mays.
Occasionally we tay given produce that appeared
singly and moved rapidly in range and we serbed those to the tips of underdoner channels.
Sationary schoos Eust extended in, range is become mattinde echoes steller to those on otherway
of at 194 years when at 5.5 cm site and we suppose
that they were reflected by channel-legents that the

happened to be overdense of 5.5 GHz. The 50 cm and the 111 cm radart produced strong uchous from every flosh that we tow passing through the bases of the radars. Tenges were particularly strong on the radar with the longest pulse. Tenges on the radius with the industry passe. Items for received on the dark that transmitted polices 200 names could long up without of their terroments. Some flash of reflected only one or train the Some factor reflected only one of grant total mostly there ever may seem and a summary at this paper supplies and relating to the train values and to the dispersion of rech consecutional areas of lightning channels viewed by the reads. We radar. 1. Сеорнуя. Свя., Graen, Paper IC1103

### Oceanography

SYIO Harine gualogical processes
SEDINITARY PROCESSES IS THE OREAT LAXES
David S. Sea (Geweegraphy Program, Dapt of
Etamspherit and Geseaft Science, The Votvarmity of
Hirbigao, Ann Arbor, Hi. E8189), Robert H. Owen
and Thillip A. Hayers
endinents in the Orest Labes are subject to lour
gunstal rategories of processent isput, transport,
deposition and post-depositional alteratime. Sedisenisty input is from nosatal srosion (648), riverine inpus (268), atmospheric transport (32), and
saveral isseer source (78). Ores in the labe,
sediments along she bottom sadfor in suspension depondlog upon grain size and density. The rate of deposition in she Great Labes is variable and ranges
from nothing in some areas to over 6000 grafy in
the smaters beain of Lale Zrie. After deposition
sediments undergo bioturbetion, dissolutions of
carbonates and opal, remobilisation of many metals
hollowed by repracipitation vicibin the surficial
oxidized layer, and degradatins of organic compounds.

Sty. Geombra. Spect New Description

Journa. Bay, Guaphys, Space Phys., Paper 181109

ETES Marins geological procusses

KARIFE GROUNDT OF THE MESS SLEES PARE 1:
ANTHRETH, SURFACE SERVENT DISTRIBUTION, AND
EMELOGRAPH OF DEPOSITION

1. Pennon (Sausil Institute of duophysics,
Caironalty of Sausil, 1581 Corras Road,
Sonololu, 81 96819) and L. U. Stronchs

Env charts of balbymairy, scounic character,
and salianess distribution describe the Sausi
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Porth Parific. Five discrete types of acquesit
units have been identified on the besis of
1.3-MME scho character across the Sles and
lateryrated. Available core data and D2DP data
confired the presence of a characterisate
lithelogy for mark of she acquesit units. The
proposed affect of bottom currents on the

presect-day snylromment of deposition in the Hess Sine is evidenced by the presence of ma sconional surface, current monthly and about thinning of surface layers and truncavior of subbotton relictors. The sidespread ornsies of the shyani files of the Repaction Fractors for is stributed to the Tiov of Antarctic Settor Water. This study has shown that 1.5-MR schotharacter is a useful and senicive indicator of the Hitheleng and saviroesses of deposition (Sathypotry, schocharacter, boryon current, submarine streleg).

4765 Surface waves, cides, and see levet EFFECTO OF ISLANDS ON FOUNTRIL WAVES J. 8. Your (Geophysical Field dynomias Program, Prinseton University, Priesston, M.J. 033407 The affects of Islands on equatorially trapped uses induced by the sudden onset of ronal wind are investigated by noting the shellow water equations numerically.

The energy propagation associated with an equatorial Raivin was is olimat unefforced by an island on the equator. The energy transmission ratio is over 0.8 mean when the north-south extust of the Island is the arms as the Reaby deferention radius, it is size shawn that the Haiding islands in the Petitic Gean do not affect the energy itue associated with Kalvin waves significantly. The sea level means and the Cilbert islands in the Petitic Gean do not affect the energy itue associated with Kalvin waves significantly. The sea level means after the leist, because of in island. This result has important duplications for the interpretation of the contractual Bloomy waves (the lowest mode to the north-south Siretion) is greatly affected by an island on the equator. The energy transmission ratio is lies than 0.3 when the north-south extent of the leist is the sme on the radius of deloration (Effect of Island, equatortal wave, each level, energy transmission). I. Geophys. Bos., Green, Paper 101060

1710 Turbulence and diffusion VERTICAL TURBULENCE diFTUSTVITY FOR WEAK OF STRONG STABLE STRATIFICATION J. Welcostoch (Marional General and Athosphoric Administration, Aeronomy Laboratory, Boulder, Colorado 6510t)
A shore-timal relation is derived for the vertical turbulent diffusivity Egg in what og well as marron smalls searer[fication. This relation approximation] relating expresses Sex in terms of the buoysesy frequency (Grunt-Väleriä fraquency), the energy dissipation rese c, and the characteristic energy containing wavenumber ho. A pravious relation was itsized to strong stable strotification.
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### Geomagnetism and Aeronomy

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Outer ionocophere at middle latitudes

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### Brief information

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Anvialing of LCH EMERGY SOLAR ELECTRONS

La Address (Space Sciences Leberciery, Unimiles of Catifornia, Serkeley, Ceilfornia

lib), J. P. Mcfadden, and R. P. Lie

Mettrees folar origin in the energy range

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to 10 as fraquetly appear use farth to tepline bursts of one to several hours duration.

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In Tribuity During the Interval 1973-1978

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are discussed, in terms of siternate possibili-tiss. The 'power' with 27-day perind and its harmonics arise from fluctuations in the amplitude aligned in the direction [a] of the inial wenter itself 1946 hours! (b) perpendi-J. Geophys. Res., Ston, faper 1A1010

1160 Solar wind Interaction with moon and planets A SOURCE OF PLASMA EMBRULECE AT THE LONGENISE OF

A SOURCE OF PLANK EURBULERC AT THE [ORIGINALS OF PLANK EURBULERC AT THE [ORIGINALS OF PLANK EURBULERC AT THE [ORIGINALS OF VENUS F. S. Deniell, Jr. [Laboratory for Planker, Attacaphares, SASA/Goddard Space Elight Center, Granbelt, No. 2071]

The sisultaneous encauraments of aupreshermal lone and low frequency electric field signals at the tempease of Venus by Element Venus Instrusions and low frequency electric field signals at the tempease of Venus by Element Venus Instrusions and low frequency laured to exemine both parallel and perpendicular propagating waves for instability in the presence of planetary ions added to the flowing tempease of planetary ions added to the flowing tempease for instability in the presence of planetary ions added to the flowing tempease for instability in the presence of planetary ions added to the flowing tempease found to be unatable. Perpendicular propagating waves are found to be unatable. Perpendicular propagating descroostate Berestein waves are lound to be quites unstable and to have the propar frequency-weelength relation to be Doppler shifted too the observed 100 Rz frequency channel. The growth rates can be substantial, and the instability occurs for a wide range of lonesheath conditions. It is difficult for an alsortic field sequencement to distinguish between these waves and electromagnetic waves such as visiblers. Elements you are probably charmalized only after several gyroperiods so that chay may be easily observed only well downstream from the planet.

5380 Soler wind plasma
INTERPLANETARY ALPYENT FUCTUATIONS:
A STORMATTARY ALPYENT FUCTUATIONS:
A STORMATIC MODE.
A SATURE (Ames Research Center, MASA, Meffest Yield, Geliformia 96035)
The strong alignment of the average direction of minimum magnesis usrience and mean magnesis related in increplements yield an increplement yield wave propagation models. Us investigate the concept of minimum variance for neoptement Alfuentifuctantions in which the liald direction content of the sinder wariance and mean field directions to be aligned only be pursty a consequence of the rendomness of the field direction of minimum variance does most imply that the fluctuarions are necessarily planer. The livetuation power spectuals a power law for frequencies such higher shan the inverse of shall be not related to the correlation sime. The probability distribution of directions for a readenty flucesscing field of constant magnitude is calculated. A sew opproach for observasional suggested.
J. Geophys. Res., Plue, Paper 1A0138

5180 Soler aind plasma
PROMOMENT PROTON CORE TEMPERATURE ANISOTROPI,
100 DIFFERENTIAL SPEED, AND SIMULTANEOUS ALFVEN
MAYE ACTIVITY 18 SLOW SOLAR WING AT 0.3 AU
1. Martch (Max-Plenct-incluit für Agronomie,
1411 Kalienburg-Lindeu 1. Federel Republic of
Germany) E.M. Pühihbuser, H. Posenbauer,
8. Schwenn end E.U. Denthat
In the Melior-2 perihelion (0.3 EU) in May
1978 pronouscad ton differentic! Impedi Swap 0
and lerge proton imperature enlectropler—
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indicate that tirong wave translines only heat
the protons but do not create a fatt soler wind.
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### Particles and Fieldslonosphere

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Measton AFE, MA OFFILE J. Across and F. Pich technification observations of Vin and LHP froquencies at auroral and aubanceral stations, together with in-mitta measurements he 1815-2 in 1911-12 and SH-t in 1911-12 and station are related to the plannagume and to the auroral and and staddio the initiate electron density rogion of the trough. The planmapause irregularities are located on the equatorwards ndgs of the trough and may extend accept degree in latitude. The section of another trough and in latitude. The section of the trough in the lectioning of the region where auroral oval T layer irregularities are present.

Using SH-2 observations of electron and ion density, electron temperature, magnetic fields and precipitating particles, it is suggested that the production mechanism of the plannagume tragularities in the temperature gradient drift instability. It is also shown the auroral irregularities are the temperature gradient drift instability. regularities in the harperature gradient drift instability. It is also show the suroral ir-regularities are closely related to field-aligned ite. Il region irregularizies, scintilla tionst. J. Geophys. Res., Slue, Pagar lAille

J. Geophya. Res., Siue, Paper IAII16

1560 Particle prestpitetion

MAGNETIC RIELD ALIGNED PLECTROF distributions in

THE DATIGUE ONE

L. J. Lansel, T. A. Petenza (Applied Physins
Laboratory, the Johns Replico University, Laurel,

Maryland, 1081d), J. E. Gesting, J. S. Les and

e. A. Holfman

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The location of the cusp was wallied by the

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of a few tuse of sV ware observed in the low al
titude cusp as expected. Sowwar, the natistand
ing result them has emarged from this study is

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upon the "normal" cusp Marwellian background of

liotropic svectrons. You attrament getectron

fluxes appear in about half the cusp observatione,

so we believe them to be stable features it.e.,

shey are not shore butters of particles! Using

the velocity distribution contours computed from

these ff5 measuroments, we conclude that the

streaming electrons cannot be explained in tores

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#### Particles and Fields-Magnetosphere

5070 Interest tons between sular wind and megnetosphere
SOLAR WIND CONTROL of AMBORAL 2008
CONNETIC ACTIVITY
G.S. Claour, Hantituta for Planta Sementh,
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selecting of surfors a same appeapable seculity for
anlet sind power imput functions which deprend on
the select wind quantities Vef. Va., are VS., to
this assigned a least squares predictions filter
or rapides response function on the relation of the second power least to out survert some geomagnetic funda is daslagsed directly from the
date. We find that the computed imputes response
feastlops have the charactalistics of a low peas
filter with a size depty which as he dependens
as the irresign of the secry imput. While the
All lodes to present out in faited to the solby
wind sextyr functions, the AU Index shows a subsizentiality power rejuitomathy. In addition,
high frequency variations of the surdval Indicas SOLAR WHO CONTROL OF AUGURAL 2045

and some substorm expansions are not predictable with solar wind totars sion alone magnesting that internal magnetospheric processes prefault that the control the AL bales. We also that that the sparameter which deposis on VA in the solar wind has a graper relationable to sureful some reconstructs artistic than a power principle. A critisis than a power principle and the sureful solar sind deposits of the sureful solar sind deposits of the solar wind solar win

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Patent Independent of State Tide bett particles was observed by los States Instrumentation of the States Table-98 (25°%) longitude: at seasons a systematic Table-98 (25°%) longitude: at seastainary crolt. This injection was closely associated with the onset of a major relation later of the Components of capetit records at tetrogen (22°%) and later than by many negative pays in the Hocomponents of capetit records at tetrogen (22°%) and later appropriate Table-98 (25°%) longitude: a tetrogen (22°%) and state the tetrogen record of wisher that is a substorm essension once interesting of the magnetic field at synchronous orbit into a tablitude configuration and by a localization distributions at geoscationary orbit that a tablitude configuration and by a localization of highly organitic field importance in this case are any other awaiting dues note.

The first is a well-timed set of ffor durand major taken turing the course of the gradth and espandion phases of the major or a williary dues note. The first is a well-timed set of ffor durand index them turing the course of the gradth and espandion phases of the major region. The second relevant data set is a broad set of richeser lata from Saparias Lations in shore general menticity in the visible galar region. The second received data set is a broad set of richeser lata from Saparias Lations in shore general menticity in the visible galar region. The second received data set is a broad set of richeser lata from Saparias Lations in shore general menticity in the visible galar region. The second received data set is a broad set of richeser lata from Saparias Lations in a shore general menticity in the visible galar i and rethern Sconlinerial from magnetic latitudes of sty to spot, the rismeter latin air while clearly that Ingra was no measurable submore 

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